Experimental Investigation of Defrost Using Warm-Liquid Refrigerant

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In a refrigeration system, the defrost method for evaporator coils has a measurable impact on the food product integrity, system energy usage, and on thermal stresses of the components, which can result in increased refrigerant leaks. The current defrost methods used by the supermarket industry do not successfully address all these issues. Recently, warm-liquid defrost has been proposed as a more comprehensive solution. Prior tests were limited to observing the defrost process on a single coil by pumping through warm-liquid refrigerant. The acceptance of this alternative defrost method required an experimental verification in a system and under conditions closer to those in a supermarket. The implementation of the method also required addressing design issues, including the addition of a suction accumulator to protect the compressor from liquid slugging. This paper reports the results from tests of a low-temperature system with two open and two reach-in display cases. The tests were performed at condensing temperatures ranging from 10 to 40 °C and at an evaporating temperature of –34 °C. The performance of the system with warm-liquid defrost was compared against the system with electric defrost at the same test conditions. The results confirmed the ability of the method to complete defrost at condensing temperatures above 15 °C. At lower condensing temperatures, the refrigerant tends to migrate from the receiver into the suction accumulator. For comparable defrost times, the product temperature rise during warm-liquid defrost was less than for electric defrost, indicating a potential for improved product integrity. No energy benefits were observed.